

Gentlefolk,

I wish to express my deep concern about the proposals being discussed to allow and encourage the use of radio-frequency signals on AC power lines (BPL) as a means of providing Internet access to urban and rural locations.

The frequencies which would be used in these BPL systems overlap those used by a wide range of licensed radio services, including international short and medium wave broadcasting, various military and government traffic and emergency services, and the Amateur Radio Service. Based on both the theory of BPL operation, and the actual test reports I have read, it appears very likely that all of these services would suffer from significant to severe interference if BPL systems are deployed widely within the continental United States.

There are several systems already in use today, which send wide-band RF signals over non-broadcast media as a way of distributing information. The two best-known are cable television (via coaxial cable) and various DSL modulations (via twisted-pair telephone line). Both of these systems are known to have the potential to interfere with licensed uses of the RF spectrum. Leakage of signal from incorrectly-installed or defective cable television equipment is probably the best-publicized of these problems. These problems are held to within reasonable limits due in large part to the fact that cable TV and DSL systems use wiring systems which are either self-shielding (coaxial cable) or well-balanced (twisted pairs).

Power lines have no such balance or shielding. If an Access BPL signal is sent over conventional high- or medium-voltage power distribution lines, it is *inevitable* that the lines will radiate RF - the use of two separate conductors, separated by one or more feet, ensures that the lines *will* act as an antenna. A neighborhood, city, or county full of BPL-enabled power lines will act as a huge array of antenna elements, each emitting a wide-band spectrum of poorly-correlated signals... in short, the power system will act as a gigantic transmitter of electronic noise. Due to the fact that most high-voltage power lines use conductors mounted at similar heights, a significant portion of the noise radiated from the lines will be emitted at a relatively low angle above the horizon - a condition which long-distance propagation of the noise by means of shallow reflections from the ionosphere. These are inescapable results of the physics of the system, and no amount of wishful thinking can make them go away.

The next question is, how bad will the noise be, and how much effect will it have on the various services which are licensed to use the RF frequencies in question? Unfortunately, the problem appears to be a severe one. Simple calculations (e.g. as presented by ARRL's Ed Hare) show that a BPL system operating at the Part 15 legal emission limit will result in overwhelming interference to amateur-radio equipment located nearby. It can be expected that transmitters and receivers used in other licensed radio services would be vulnerable to a similar degree. Even a system which "notched" out the amateur-radio frequency bands by 99.9% (30 dB attenuation) would raise the background noise level on these bands by much as 30 dB over their current levels.

I'm very concerned about the impact that this would have on amateur radio operations, both here in the United States and around the world. An increase in the noise level of this magnitude would seriously reduce the usability of the amateur radio bands. I foresee several likely consequences:

1. Many amateur radio operators live in circumstances which prohibit the use of efficient outdoor antennas (due to e.g. restrictive rental agreements, homeowners' association covenants, etc.). These amateurs are restricted to using various forms of "stealth" antennas - small whips, indoor dipoles and loops, and so forth. These antennas have reduced sensitivity, and their proximity to people and to electronic equipment limits the amateur radio operator to using low power while transmitting. If BPL systems raise the ambient noise level significantly, these amateur radio operators will neither "hear" other stations (due to the local noise) nor will they be "heard" by others (due to their limited transmitting power). These operators will have been put "off the air" by BPL and will be unable to use the license privileges that they have earned by study and practice.
2. Amateur operators are encouraged by good operating practice, and are required by FCC regulation (97.313(a)), to use the least amount of transmitted power and bandwidth needed to establish a particular mode of communication. This practice allows for an optimal sharing of the (often very busy and crowded) amateur radio bands, reduces human exposure to RF energy, and minimizes the risk that high-power RF transmissions will cause undesirable interference to other devices (e.g. televisions, radios, various Part 15 devices, etc). If the deployment of BPL systems raises the ambient noise level by 30 dB, then in many cases the "minimum transmitter power necessary to carry out the desired communication" would also increase by 30 dB. An amateur who could previously have communicated efficiently using only a few watts of power (unlikely to cause local interference) would then need to increase her transmissions to the maximum legal limit of 1500 watts to achieve a similar communication. This would result in a greatly increased risk of "RF overload" to poorly-shielded televisions, radios, telephones, etc. located within a distance of several blocks of the amateur station. It can be expected that various other radio services (e.g. MARS) would also have to boost their transmitter power to "cut through" BPL interference, with similar ill effects on nearby electronics.
3. BPL systems themselves would be very likely to be adversely affected by transmissions from amateur radio, and other licensed radio services. Just as it is inevitable that BPL signals will "leak out" from power-line wiring as RF radiation, it is inevitable that licensed radio service transmissions will "leak in". The BPL modems in consumers' homes would be affected by these transmissions, both as co-channel interference and as a result of fundamental overload of the modems' RF stages and analog-to-digital converters. These effects could result in BPL service which would become intermittent, degraded, unreliable, or completely unavailable whenever a licensed transmitter went "on the air" anywhere nearby.
4. The degradation of the quality of the HF amateur radio bands would have a severe impact on the number of amateurs who study for, and qualify to use this aspect of the amateur radio service. The privilege of operating on the HF bands is the primary "lure" which encourages new amateur operators to undertake the extensive learning of radio theory and operational practice needed to qualify for a General or Amateur Extra class of license. If

the HF bands become unusable due to BPL interference, or if the "cost of entry" for HF operation is raised to prohibitive levels by the need to have a kilowatt-capable transmitter, the number of amateur operators who study to qualify for these advanced classes of license will plummet. This will defeat the stated intent of the Amateur Radio Service as stated in 97.1, and will greatly reduce the ability of the Amateur Radio Service to work for the public good.

During the recent ARRL Field Day drill, I activated my own Amateur Radio station using only emergency backup power (a solar-charged battery) and made direct radio contacts with other operators all across the country. Tens of thousands of other amateur operators did likewise, to demonstrate our readiness to provide service in time of emergency or disaster. If BPL systems had raised the ambient noise level by 30 dB, I believe that my ability to make contact would have been degraded by 90% or more. Other amateur operators, MARS, CAP, and similar licensed long-distance radio services would probably suffer a similar degradation in their communication capability.

I'm quite sceptical as to the ability of the nation's power utilities to serve as effective and responsible operators of a radio service (albeit unlicensed). Our power distribution network was not built to carry RF. Local and regional power companies have not had incentive to develop or acquire expertise in radio engineering. Although power distribution equipment has the potential to interfere with radio services (due to e.g. arcing of damaged or dirty insulators), power companies have often been remiss in their legal responsibility to abate such interference (as I'm sure a review of the FCC's own files will demonstrate). Here in California, the major electrical utilities have been cited repeatedly for failing to perform necessary maintenance and upkeep on their lines and equipment (inadequate tree-trimming leading in several cases to severe forest fires!) and inadequate staffing of emergency-repair teams. I question the wisdom of placing a completely new (and potentially interfering) portion of our communications infrastructure in the hands of a utility industry whose physical plant seems ill-suited to the job, whose scope of competence is in such a different area, which seems to be having some difficulty fulfilling even its primary role, and which has a questionable record regarding RF interference issues.

I'm also struck by irony involved in the use of BPL, which seeks to *add* broadband noise to our power lines. For years, manufacturers have been required by Part 15 regulations to ensure that consumer electronics do not emit more than small amounts of radiated or conducted noise. In many cases this has required the use of power-line noise filters on equipment such as computers, DVD players, etc. These filters tend to act as a low impedance to radio-frequency energy on the power line, and thus will tend to "short out" the BPL signal. Thus, the better-built the equipment is, and the more "noise and surge" protection the consumer has installed, the more thoroughly it will "ground out" the BPL signal in the nearby power line, and the worse the BPL signal quality and data rate will be. This may require the BPL operator to increase the BPL signal power, thus increasing spurious emissions. Thus, the very Part 15 rules which attempted to reduce interference, may result in an *increase* in interference from BPL!

It is also apparent from recent history that the Part 15 "absolute limits" on RF emissions are not, by themselves, sufficient to ensure that the Part 15 equipment won't interfere with licensed radio operations. As other writers have reported, the ambient background noise levels on several Amateur Radio bands have increased greatly in recent years, due to the deployment of large numbers of unlicensed Part 15 devices which use these frequencies. Noise levels are now so high that amateur operation on these bands (both local, and weak-signal) has become difficult or impossible in many area. I believe that the FCC must carefully examine these emissions limits, and consider the total impact of having tens or hundreds of thousands of devices of a given type deployed in a metropolitan area. A little bit of RF interference, multiplied by lots of radiators, can add up to a lot of noise!

In summary, it appears to me that BPL spells nothing but trouble for numerous licensed radio services. Its potential for interference appears to be very high indeed. Its benefits appear questionable and unproven.

I thus urge as follows:

1. The existing Part 15 regulations prohibiting interference to licensed radio services *must not* be relaxed, and must be actively enforced.
2. Part 15 regulations on "absolute maximum" emissions should be reconsidered. The limits considered acceptable today, may be too high to allow for large numbers of systems to be deployed without interference. If careful study shows that this is the case, the FCC should consider tightening the "absolute maximum" emissions limits for Part 15 devices.
3. The burden of proof *must* be placed where it belongs by law and fairness: on those who argue that BPL *will not* interfere with established, licensed radio services.

Respectfully yours,

David C. Platt
Amateur Radio licensee AE6EO